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(54) Title of the Invention A SEMICONDUCTOR WAFER POLISHING DEVICE

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SPECIFICATION

1. Title of the Invention

A SEMICONDUCTOR WAFER POLISHING DEVICE

2. Scope of Patent Claim

Regarding a semiconductor wafer polishing device, which measures degree of roughness on a polished surface of a semiconductor wafer and based on this measurement determines whether polishing should be continued or terminated, a semiconductor wafer polishing device is characterized by a light emitting device, which can irradiate a polished surface of a semiconductor wafer placed on a polishing stage, and a light receiving device, which can measure an amount of light reflected from the abovementioned semiconductor wafer surface, and a controlling means, which determines whether polishing should be continued or terminated based on the measurement of the light receiving device.

3. Detailed Explanation of the Invention

[Industrial Fields of Application]

This invention is related mainly to a semiconductor wafer polishing device, which measures roughness of a polished surface of a Ga ·As semiconductor wafer to determine continuation or termination of a polishing process.

[Prior Art]

A semiconductor wafer, on the (100) side of which a circuit pattern and other stuff have formed through various steps, is going to be polished to a thickness suitable for implementation prior to dicing. For this the back side, the ($\bar{1}$00) side, is polished. For a die bonding process that follows, the ($\bar{1}$00) side needs to retain a desired die bonding strength, so a certain degree of roughness is required. This polished side, however, is easily affected by conditions of whet particles on a whet stone surface; it is difficult to polish in a continuous manner a semiconductor wafer with consistency. Therefore, in the past, to examine a polished surface of a semiconductor wafer, the wafer was frequently removed from a polishing table and surface roughness was measured. And when a desired surface roughness was attained, polishing was terminated to start polishing a new semiconductor wafer, or when a desired surface roughness was not attained, the semiconductor wafer was returned to the polishing table to continue polishing.

[Problems to Be Solved by the Invention]

As has been explained, in the conventional polishing device, to measure roughness, a semiconductor wafer frequently needed to be removed from a polishing table, and as a result the duration of an entire polishing process was unfavorably long.

The purpose of this invention is to provide a semiconductor wafer polishing device, which can shorten the duration of a polishing process as a whole, by reducing measurement time.

[Means for Solving Problems]

In his invention to attain the purpose mentioned above, regarding a semiconductor wafer polishing device, which measures degree of roughness on a polished surface of a semiconductor wafer and based on this measurement determines whether polishing should be continued or terminated, a semiconductor wafer polishing device is characterized by a light emitting device, which can irradiate a polished surface of a semiconductor wafer placed on a polishing stage, and a light receiving device, which can measure an amount of light reflected from the abovementioned semiconductor wafer surface, and a controlling means, which determines whether polishing should be continued or terminated based on the measurement of the light receiving device.

[Actions]

From a light emitting device light is emitted to a desired point on the polished surface of a semiconductor wafer, and an amount of reflected light is measured with a light receiving device. When an amount of received light exceeds a certain value, it can determined that the polished surface has reached to a certain level of smoothness, or when an amount of received light does not exceed a certain value, it can determined that the polished surface has not reached to a certain level of smoothness.

Thus, a polishing device equipped with a light emitting device and a light receiving device, with which surface roughness can be measured optically, can measure a polished surface without removing a semiconductor wafer from a polishing stage as was done in the conventional method; with a controlling means, continuation or termination of polishing can be determined immediately.

[Embodiment]

By using Diagram 1, a Ga-Aa semiconductor wafer polishing device of this invention is explained.

This polishing device (1) is to polish a semiconductor wafer (W), which has been through various processes, to a thickness suitable for implementation prior to a dicing process, equipped with a polishing stage (2), which fastens the semiconductor wafer (W) by suction, and a whet stone (3), which polishes the semiconductor wafer (W), over the polishing stage. The polishing stage (2) rotates the semiconductor wafer (W) fastened by suction to it by a motor (not illustrated) connected to a rotating axis (4). The whet stone (3) goes up and down while rotating by a motor (not illustrated) connected to a driving axis (5). Thus, during polishing, the semiconductor wafer (3) itself slowly rotates, the polished surface, the (100) side, of which is simultaneously polished evenly by the whet stone (3), which is gradually coming down while rotating.

Also, over the polishing stage (2), a light emitting component (6) of a light emitting device and a light receiving component (7) of a light receiving device are connected with fastening parts (not illustrated). From this light emitting component (6) to a measuring point (P) on the surface of the semiconductor wafer (W), that is, the polished surface, light gathered through a light emitting lens is emitted; reflected light from the measuring point (P) is received through a light receiving lens on the light receiving surface of the light receiving component (7). Therefore, based on an amount of reflected light surface roughness of the polished surface is determined.

Moreover, the light emitting component (6) and the light receiving component (7) are to measure at least three measuring point (P)s, so they are designed to move relatively by a moving device (not illustrated). The total number of measuring point (P)s was decided to be three, that is, the center point of the semiconductor wafer (W) and two points along the diameter, which sandwich the center point on the center line intersecting at a right angle with the orientation flat (Wa) of the semiconductor wafer (W), because in the Ga-Aa semiconductor wafer (W), roughness tended to worsen in the fan-shaped area (Wa) covered by sloped lines in Diagram 2 due to anisotropy of crystals, and in this kind of polishing method, in which a wafer is also rotated, roughness tended to worsen in the center area of a wafer.

When measured values of all these three points satisfy the standard values, polishing is terminated; when even one of them does not satisfy the standard values, polishing is continued.

This is specifically explained in Diagram 3 in conjunction with the control of a polishing device (1). A light emitting device is composed of a light emitting component motor circuit (8) and a light emitting component (6). By a signal from the light emitting component motor circuit (8) that has detected the completion of the rise of a whet stone (3), while a polishing stage (2) is rotating, from the light emitting component

(6) by light driving to each measuring point (P) light is emitted in turn. On the other hand, a light receiving device is composed of a measuring device of received light (9) and a light receiving component (7). Reflected light from each measuring point is received by the light receiving component (7), and then measurement is performed by the measuring device of received light (9). The measuring device of received light (9) sends a signal to a termination controller (10), when an amount of reflected light reaches to a desired value at all measuring points, or to a continuation controller (11), when an amount of reflected light does not reach to a desired value at even one of the measuring points. By this signal, the termination controller (10) controls a motor of a transport device (12) to send out the semiconductor wafer (W), polishing of which has been completed, and set a new semiconductor wafer (W) on a polishing stage (2). Or by this signal, the continuation controller (11) controls a motor (13) connected to a polishing whet stone to continue polishing.

As designed above, a semiconductor wafer (W) can be measured still set on a polishing stage (2) as well as by rotating a light emitting component (6), measurement can be performed while the polishing stage (2) is rotating; with the two steps performed at the same time, termination or continuation of polishing is immediately determined.

[Effects of the Invention]

As has explained so far, because surface roughness of a semiconductor can be measured on a polishing stage, duration of a polishing process can become shorter, and also accidental damages that occurred in the past, when a semiconductor wafer was set on or removed from a polishing stage, can be avoided; as a result, productivity can be improved.

4. Brief Description of the Diagrams

Diagram 1 is a sketch of an embodiment of this invention of a semiconductor polishing device, Diagram 2 is a top view of measuring points of a semiconductor wafer, and Diagram 3 is a flow chart of measurement control of surface roughness.

1 ..... a polishing device
2 ..... a polishing stage
6 ..... a light emitting component
7 ..... a light receiving component
8 ..... a light emitting component motor circuit
9 ..... a measuring device of received light
10 ..... a termination controller
11 ..... a continuation controller
W ..... a semiconductor wafer

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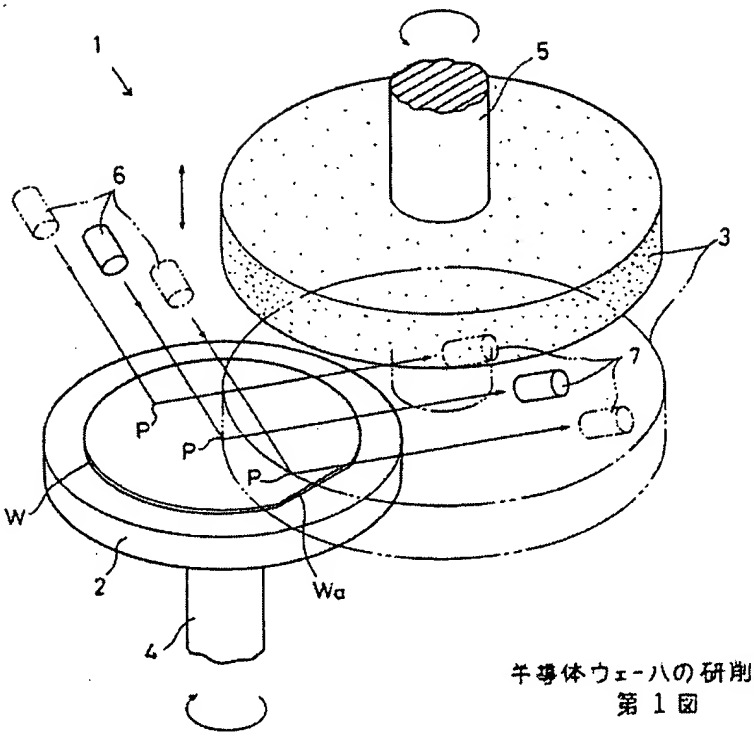
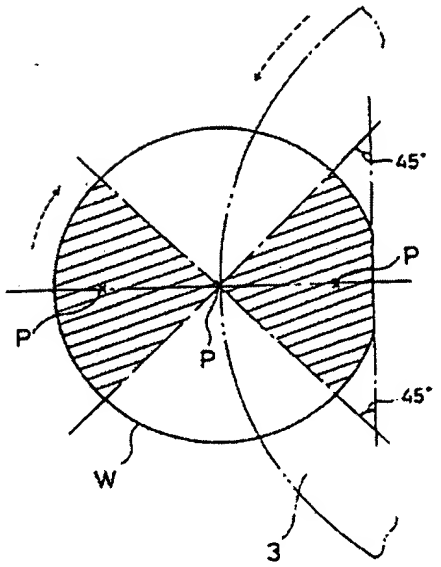


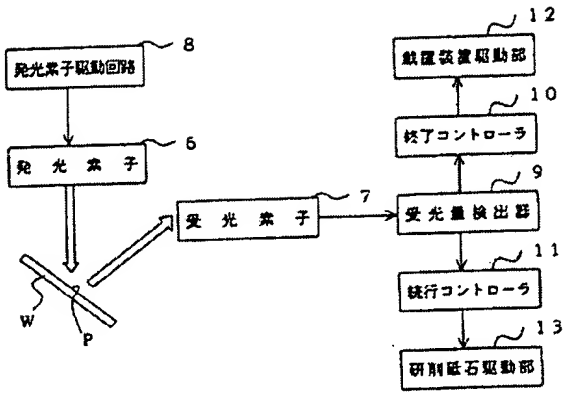
半導体ウェーハの研削装置
第 1 図

Diagram 1. A semiconductor wafer polishing device.



半導体ウェーハの(1̄00)面
第 2 図

Diagram 2. The ($\bar{1}$00) side of a semiconductor wafer.



面粗さ測定の制御フロー

第 3 図

6. a light emitting component
7. a light receiving component
8. a light emitting component motor circuit
9. a measuring device of received light
10. a termination controller
11. a continuation controller
12. a motor of a transport device
13. a motor connected to a polishing whet stone

Diagram 3. The flow chart of measurement control of surface roughness.

POLISHING DEVICE FOR SEMICONDUCTOR WAFER

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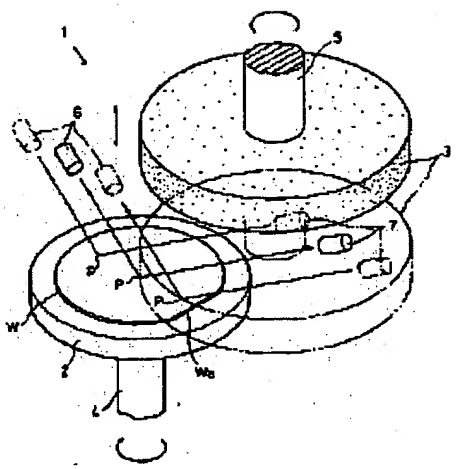
Applicant: SUMITOMO ELECTRIC IND LTD
Classification:
- international: H01L21/304; B24B7/20; B24B49/12
- european:
Application number: JP19890044653 19890223
Priority number(s):

Abstract of **JP2222533**

PURPOSE:To cut down the time required for the measurement thereby enabling the time for the whole polishing process to be cut down by a method wherein the title polishing device of semiconductor wafer is provided with an illuminating device capable of irradiating the polished surface of the semiconductor wafer, a photodetector capable of detecting the reflected light quantity and a control means deciding the termination or continuation of the polishing work conforming to the results of measurement by the photodetector.

CONSTITUTION:The title polishing device 1 of semiconductor wafer capable of measuring the roughness of a polished surface of the semiconductor wafer W and deciding the termination or continuation of the polishing work conforming to the results of measurement is provided with an illuminating device capable of irradiating the polished surface of the semiconductor wafer W mounted on a polishing stage 2, a photodetector capable of detecting the reflected light quantity and a control means deciding the termination or continuation of the polishing work conforming to the results of measurement by the photodetector. For example, illuminating elements 6 comprising the illuminating device and photodetecting elements 7 comprising the photodetector are provided so that the surface of the semiconductor wafer W i.e., the measurement points P on the polished surface may be irradiated with the light focussed from the illuminating elements 6 through the projecting lens to detect the reflected light from the measurement points P on the photodetecting surfaces of the photodetecting elements 7 through the photodetecting lens.



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審査請求　未請求　請求項の数 1　(全4頁)

⑤4発明の名称　半導体ウエーハの研削装置

⑳特　願　平1-44653
㉒出　願　平1(1989)2月23日

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明　細　書

1．発明の名称

半導体ウェーハの研削装置

2．特許請求の範囲

半導体ウェーハの研削仕上げ面の面粗さを測定し、この測定結果に基づいて研削作業の終了又は続行を決定する半導体ウェーハの研削装置において、

研削ステージ上に載置した半導体ウェーハの研削仕上げ面に光を照射可能な発光器と、この光の反射光量を検出可能な受光器と、受光器の検出結果に基づいて研削作業の終了又は続行を決定する制御手段とを備えたことを特徴とする半導体ウェーハの研削装置。

3．発明の詳細な説明

〔産業上の利用分野〕

本発明は、主としてGaAs半導体ウェーハの研削仕上げ面の面粗さを測定して、研削作業の終了又は続行を決定する半導体ウェーハの研削装置に関する。

〔従来の技術〕

各種処理工程を経て回路パターン等が(100)面に形成された半導体ウェーハは、ダイシング工程の前に実装用の厚さに研削される。その際裏面の($\bar{1}$00)面が研削されるが、この($\bar{1}$00)面は後のダイボンディング工程で所定のダイボンディング強度を必要とすることから所定の面粗さを要求される。しかし、この仕上げ面は、研削時における砥石表面の砥粒の状態により変化を受け易く、半導体ウェーハを連続して安定に研削するのは難しい。このため、従来は半導体ウェーハの仕上げ状態を確認すべく、その都度研削テーブルから取外して面粗さを測定するようにしている。そして、所定の面粗さの基準値を満たせば研削作業の終了して次の半導体ウェーハの研削を実行し、満たさない場合には半導体ウェーハを研削テーブルに再度セットして研削作業を続行するようにし

ている。

〔発明が解決しようとする課題〕

このように従来の研削装置にあっては、面粗さを測定する場合に半導体ウェーハをその都度研削テーブルから取外さねばならないため、研削工程全体に要する時間が長くなる不具合があった。

本発明は、測定に要する時間を短縮して研削工程全体の時間短縮を図る半導体ウェーハの研削装置を提供することをその目的とする。

〔課題を解決するための手段〕

本発明は上記目的を達成すべく、半導体ウェーハの研削仕上げ面の面粗さを測定し、この測定結果に基づいて研削作業の終了又は続行を決定する半導体ウェーハの研削装置において、研削ステージ上に載置した半導体ウェーハの研削仕上げ面に光を照射可能な発光器と、この光の反射光量を検出可能な受光器と、受光器の検出結果に基づいて研削作業の終了又は続行を決定する制御手段とを備えたことを特徴とする。

〔作用〕

発光器により半導体ウェーハの研削仕上げ面の任意の点に光を照射し、この光の反射光量を受光器で検出する。このとき受光量が一定量以上あれば研削仕上げ面が所定の平滑さにに仕上がっていると判断でき、一定量以下あれば所定の平滑さに仕上がっていないと判断できる。

このように研削装置に光学的に面粗さを測定可能な発光器と受光器とを備えることにより、従来のように半導体ウェーハを研削ステージから取外すことなくその研削仕上げ面の測定を行うことができ、制御手段を備えることにより、直ちに研削作業の終了又は続行を決定できる。

〔実施例〕

第１図を参照して本発明を実施したＧａＡｓ半導体ウェーハの研削装置について説明する。

この研削装置１は、各種処理工程を経た後の半導体ウェーハＷをダイシング工程の前に実装用の厚さに研削するもので、半導体ウェーハＷを吸着により載置固定する研削ステージ２と、その上方に半導体ウェーハＷを研削する研削砥石３とを備えている。研削ステージ２は、回転軸４に連結された駆動装置（図示せず）により半導体ウェーハＷを吸着した状態で回転し、また研削砥石３は、駆動軸５に連結された駆動装置（図示せず）により回転しながら昇降動する。したがって、半導体ウェーハＷは研削の際に自らゆっくり回転すると共に、回転しながら除々に下降してくる研削砥石３により、その研削仕上げ面である（$\bar{1}$００）面が均一に研削される。

また、研削ステージ２上には、図示しない固定部材により発光器を構成する発光素子６と受光器を構成する受光素子７とが設けられており、この発光素子６から半導体ウェーハＷの表面、すなわち研削仕上げ面の測定点Ｐに投光レンズを介して集光された光が照射され、測定点Ｐからの反射光は受光レンズを介して受光素子７の受光面で受光される。そして、この反射光の光量の多少により研削仕上げ面の面粗さが測定される。

また、発光素子６と受光素子７とは、少なくとも３箇所の測定点Ｐを測定するため、移動装置（図示せず）により相対的に移動できるように構成されている。測定点Ｐは、ＧａＡｓ半導体ウェーハＷが結晶の異方性によって第２図の斜線で示した扇状領域Ｗａ，Ｗａで面粗さが悪化し易いこと、及びウェーハも回転させるこの種の研削方式では、ウェーハの中心部分の面粗さが悪化し易いことに鑑みて、半導体ウェーハＷの中心点と、半導体ウェーハＷのオリエンテーションフラットＷａに直交する中心線上の中心点を挟んだ径方向の２箇所の合計３箇所とした。

そして、この３箇所の測定値のすべてが基準値を満たせば研削を終了し、１箇所でも基準値を満たさない箇所がある場合には再研削を行う。

これを第３図に示すように具体的に研削装置１の制御と関連させて説明する。発光器は、発光素子駆動回路８と発光素子６とから構成され、研削砥石３の上昇完了を検知した発光素子駆動回路８の信号により、研削ステージ２を回転させた状態で発光素子６から点灯駆動により各測定点Ｐに順

次に光が照射される。一方、受光器は受光量検出器９と受光素子７とから構成されており、各測定点Ｐからの反射光が受光素子７により受光され、続く受光量検出器９で反射光量が検出される。受光量検出器９はすべての測定点で反射光量が所定の値に達している場合には終了コントローラ１０に信号を送り、いずれか１箇所でも反射光量が所定の値に達しない場合には続行コントローラ１１に信号を送る。終了コントローラ１０はこの信号により移載装置駆動部１２を制御して、研削を完了した半導体ウェーハＷを払出し、新たな半導体ウェーハＷを研削ステージ２上にセットする。一方、続行コントローラ１１はこの信号により研削砥石駆動部１３を制御し、研削作業を続行する。

以上のように構成すれば、半導体ウェーハＷを、研削ステージ２上にセットした状態で測定できると共に、発光素子６を点灯駆動させることより研削ステージ２を回転させた状態で測定することができ、同時に研削作業の終了又は続行へ瞬時に移行することができる。

〔発明の効果〕

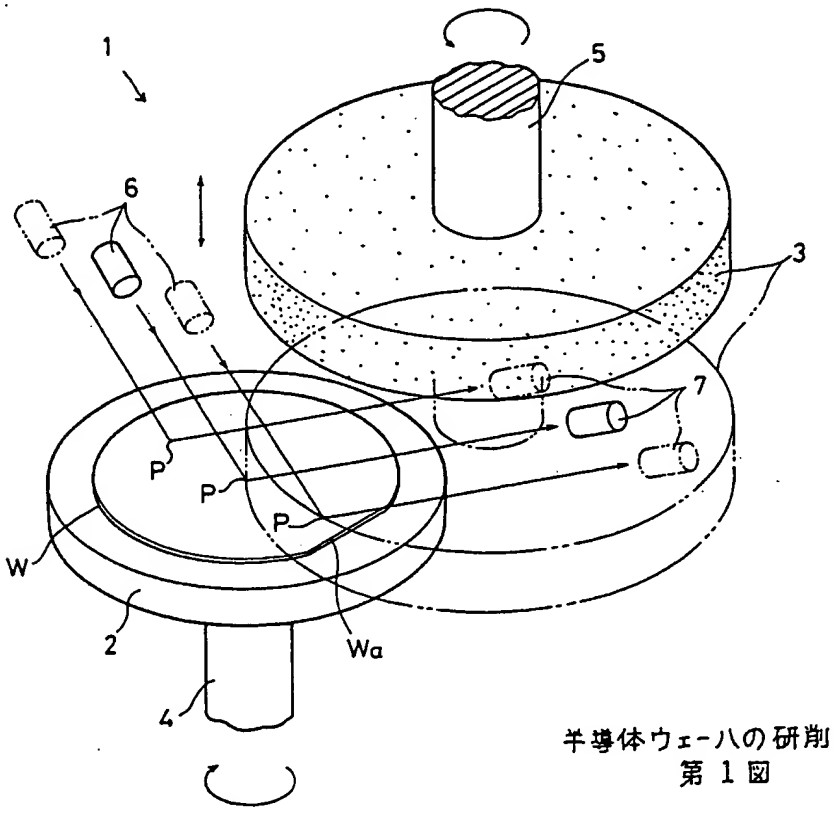
以上のように本発明によれば、半導体ウェーハの面粗さを研削ステージに載置した状態で測定できるため、研削工程に要する時間が短縮でき、しかも、従来のように半導体ウェーハを研削ステージからの着脱する際に誤って破損することも防止でき、生産性を向上し得る効果を有する。

４．図面の簡単な説明

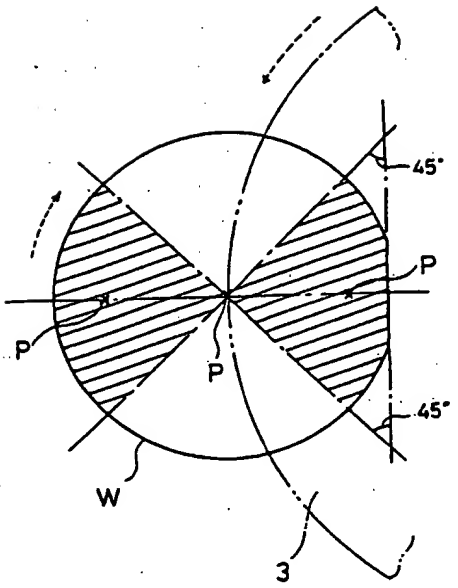
第１図は本発明を実施した半導体ウェーハの研削装置の概略図、第２図は測定点を示した半導体ウェーハの平面図、第３図は面粗さ測定の制御フロー図である。

１…研削装置、２…研削ステージ、６…発光素子、７…受光素子、８…発光素子駆動回路、９…受光量検出器、１０…終了コントローラ、１１…続行コントローラ、Ｗ…半導体ウェーハ。

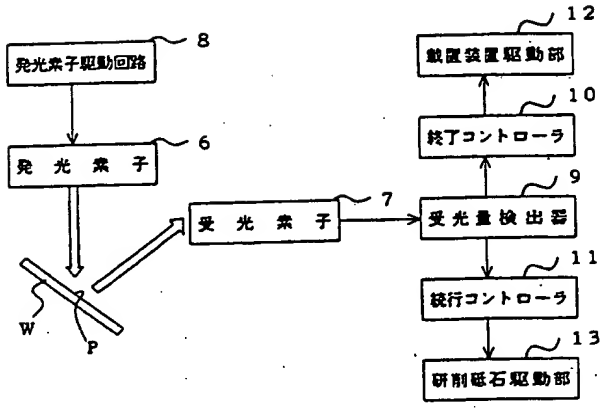
特許出願人　住友電気工業株式会社
代理人弁理士　長谷川芳樹



半導体ウェーハの研削装置
第１図



半導体ウェーハの(1̄00)面
第２図



面粗さ測定の制御フロー
第３図